ACHYLIA GASTRICA.

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Achylia gastrica we understand to be a condition which manifests itself clinically by a persistent absence of free as well as combined hydrochloric acid and also by the absence of gastric ferments.

The total acidity after an Ewald test breakfast is below 10 and after a Leube-Riegel test-meal it may reach as high as 20. In other words we are dealing in achylia gastrica with a complete loss of one of the main functions of the stomach—namely, with that of digestive secretions.

Einhorn[1] was the first to name this disease achylia gastrica. He advanced at the same time the theory that the affection is neuropathic, based on his numerous clinical observations that the gastric contents while showing the absence of active secretions failed to show any pathological evidence of gland destruction.

Martius[2] was likewise of the opinion that achylia gastrica is a neuropathic disturbance of gastric secretions, but he considered it to be in the majority of cases of congenital origin. Different authors (Albu[3] and others) upheld Martius by showing that the disease is not so rare in childhood.

Ewald,[4] who called the affection anadeny gastrica, was of the opinion that it is the atrophy of the gastric glands that causes the achylia.

L. Kuttner,[5] a pupil of Ewald, is so firmly of the belief that achylia gastrica is only the result of a complete disappearance of the gastric glands that he goes so far as to assert that achylia gastrica is a progressive stage of gastritis anacida; in fact, he wishes to have the name gastritis anacida replace the term achylia gastrica. He bases his assertions on the postmortem findings by himself and his pupil Lindeman, whose cases were typical of gastritis with disappearance of the digestive glands. Kuttner also states emphatically that the fact that Einhorn and others found no evidences of pathological changes in the stomach contents of diseased mucous membrane or glands is no proof that there is no disease existing. Kuttner rightfully claims there may exist a pathological condition in the mucous membrane without the stomach contents showing any evidence thereof.

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[1] New York Med. Press, September, 1888; New York Med. Record, June, 1892; New York med. Wchnschr., July, 1892; New York Med. Record, June, 1894; Arch. f. Verdauungski., vol. i, No. 2.

[2] Achylia Gastrica, 1897.

[3] Berl. klin. Wchnschr., 1903, No. 41.

[4] Berl. klin. Wchnschr., 1892, Nos. 26 and 27.

[5] Krauss-Brugsch: Spec. Pat. and Ther. Innerer Krank., 1914, v, pp. 6 14.

The controversial views outlined above, coming as they do from very reliable sources, prove to us that achylia gastrica may really exist under manifold pathological conditions. In order to make clear the exact underlying cause of achylia and its clinical significance a short review of the physiology of gastric secretions and the factors that govern them is essential.

Exact studies of the physiology of gastric secretions have become possible chiefly through the ingenious studies of Pawlow[6] and his pupils, O. Cohnheim,[7] Richet,[8] Bickel,[9] Cannon, Carlson, F. Umber,[10] Pfaundler,[11] H. Strauss[12] and others.

Gastric juice is almost exclusively secreted in the fundus part of the stomach, the chief cells yielding pepsin and the parietal cells HCl. O. Cohnheim showed that these glands possess a nervous mechanism of their own. Direct mechanical or electrical irritation does not excite secretions in the stomach. On the other hand the sight of food, chewing, or smelling does excite gastric secretion, showing that psychical and reflex influences play an important role in bringing about gastric secretions. Such secretions induced by the sight of food is termed by Pawlow psychical juice; if produced by chewing it has been termed by Bickel appetite juice.

When food reaches the stomach four to six minutes elapse before secretions set in, but it meets there a secretion already possessing digestive properties and serving the purpose of chymification. Bickel demonstrated that the products of the earliest part of digestion are partially absorbed, thus stimulating the secretory and motor apparatus of the stomach.

To study gastric juices in man it is customary to give the patient a standard meal to be removed from the stomach after a definite length of time. After an Ewald test breakfast (250 grams weak tea without sugar and 50 grams white bread) Boas gives the approximate acidity figure of 0.07 to 0.2 free acid and a total acidity of 30 to 70 per cent.; after a test meal (150 grams beef, some potatoes, a plate of soup, and bread) free HCl 0.15 to 0.2 and a total acidity 75 to 87 per cent.

Pure gastric juice as obtained from a dog through the well-known experiments of Pawlow and from human beings with gastrostomy and esophagostomy (Richet, Bickel), or such as was obtained from gastrostomy patients (Umber, Carlson, Bickel), shows 0.4 to 0.5 free HCl and 100 to 140 per cent. total acidity.

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[6] Die Arbeiten d. Verdauungsdrüsen, Wiesbaden, 98.

[7] Die Physiolog. d. Verdauungski. u. Ernah., Wien, 1908.

[8] Jour. de l'Anat. et Physiol., 1887.

[9] Berl. klin. Wchnschr., 1905, p. 60; München. med. Wchnschr., 1906, x, 1323; Int. Beitr. zur Path. u. Ther. d. Ernah., 1913, lxxv.

[10] Berl. klin. Wchnschr., 1905, No. 3.

[11] Arch. klin. Med., 1900, xv, 255.

[12] Berl. klin. Wchnschr., 1893, p. 398.

In gastrostomized dogs and human beings with gastric fistula it was found that disgust, anger, or fright stop gastric secretions. On the other hand the sight or smell of appetizing food or pleasing influences increase gastric secretions. Bickel found that nicotin retards gastric secretion. H. Strauss demonstrated that fats and Schuele that concentrated salt and cane-sugar solution have a retarding influence on gastric secretion. Meat juices, CO_2, alcohol, diluted sodium chloride solutions, and local heat excite gastric secretions. Most of the amara (extr. fluid colombo, extr. fluid condurang., etc.) were found by A. J. Carlson, contrary to previous belief, to retard gastric secretions.

The average quantity of gastric juice secreted in the course of the day has been calculated to amount to 1500 c.c. The acidity values take a definite course by a reflex mechanism, whereby the acidity rises gradually, reaching the highest point at the height of digestion, and gradually declining, reaching the lowest point when the stomach is empty.

Recent studies were made by Rehfuss, Bergheim, and Hawk[13] of gastric secretions by the so-called fractional method. This consists of introducing a thin weighted tube into the stomach based on the principle of the Gross duodenal tube, after an Ewald test breakfast, and aspirating every fifteen minutes, thereby studying the secretory curve. Similar work was carried on by Max Skaller[14] in Bickel's laboratory in Berlin. They found that even in health the secretory curves vary; they accordingly describe three curves:

1. The isosecretory curve, the height of secretion having a total acidity of 60 per cent., maintaining such acidity for from thirty to sixty minutes, after which it gradually declines. After two to two and a half hours there is a complete disappearance of food residue.

2. The hypersecretory type shows a rapid response to stimuli. Aspiration of contents after five minutes may show an already high total acidity. The highest is 100 per cent. with a gradual decline, and although the food has completely disappeared after two to two and a half hours there still is an outpouring of pure gastric juice for a long time thereafter.

3. The hyposecretory type, wihch is characterized by a slower ascend, a slower response to stimuli, and a high point of from 40 to 50 per cent. total acidity.

Of paramount importance to the physiology of gastric secretions are the numerous experimental studies of A. J. Carlson,[15] on his subject Mr. V., with a complete closure of the esophagus and a gastric fistula. *He found, in contradiction to Pawlow, Bickel, and Schuele* that the gastric secretions are continuous and only the quantity of the secretion differs according to the time of day and season. In the morning, on a fasting stomach, the quantity is greater than before lunch or dinner, and more in the summer than in winter. He attributes this change in quantity to the tone in the stomach. Be the quantity of secretion whatever it may it always contains pepsin and a varying degree of HCl. This continuous secretion is, according to Carlson, supposed to be due either to the continuous action of the vagus on the secretory glands or to an autodigestion of the gastric juice.

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[13] Jour. Am. Med. Assn., 1914, lxiii, 909; Am. Journ. Med. Sc., 1914, p. 848.
[14] Berl. klin. Wchnschr., 1913.
[15] Am. Jour. Physiol., 1915, xxxvii, 50. Ibid., 1915, xxxviii, 245.

Another important point brought out by Carlson, confirming the work of Pawlow and Boldyreff,[16] is that the acid concentration of gastric secretion is always the same. The higher or lower acidity obtained from a gastric fistula or through the stomach-tube depends, according to Pawlow, on the mucous secretion in the stomach, and according to Boldyreff and Carlson to the regurgitation of intestinal juice.

Gastric juice has a digestive action on proteids, converting them into peptones and polypeploids; according to Ad. Schmidt it also acts on connective tissue. O. Cohnheim says the HCl also prevents bacterial growth in the stomach, fermentation, and decomposition. Finally, HCl regulates the action of the pylorus.[17]

Normal gastric secretions are kept up by the integrity of the gastric glands, the healthy condition of the blood, and the proper control of the nerves. Disturbances in digestive secretion result when any one of these three factors is at fault.

In relation to achylia gastrica it needs no explanation that an atrophy of the secretory glands of the stomach or a marked pathological change of the blood can be a causative factor. The mode by which a purely functional disturbance of the nervous system may cause a lasting achylia, as asserted by Einhorn, needs a short discussion of the nerves directly influencing gastric secretion. This was made possible by the physiological studies of Langley[18] of the vagus-sympaticus system; the pharmacological studies of Meyer and Gottlieb[19] and the clinical observations of Eppinger and Hess[20] on the same system.

It would be out of place here to go into a detailed anatomical description of the vagosympaticus, but a few remarks on the influence of these nerves on gastric secretion are essential in order to understand how a functional disease of the nervous system can be made responsible for achylia gastrica.

It was Langley who showed that all the organs not controlled by *the will* (stomach, intestines, bloodvessels, ducts of glands) and also certain organs possessed of striated muscle fibers (the heart, the beginning and terminal portions of the alimentary canal, and the generative organs) are under the control of the vagus and sympaticus system. It was also shown and pharmacologically demonstrated by Meyer and Gottlieb that these two systems antagonize each other throughout the greater extent of their course.

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[16] Quart. Jour. Exp. Physiol., 1914, viii, 1.

[17] v. Mehrinz: XII Kongr. f. inner. Med., 1893, p. 471. Hirsch: Zentralbl. f. klin. Med., 1892, p. 993; 1893, xiv, 73, 377, 601.

[18] Jour. Physiol., 1898, xxiii, 240; 1911–12, xliii, 173.

[19] Experiment. Pharmacol., Vienna, 1912.

[20] Zur Path. d. Veget. Nerven-System, Ztschr. f. klin. Med., lxvii lxviii, 205, 315.

In reference to gastric secretions, which concern us here most, it was shown that the vagus excites secretions and the sympaticus inhabits secretions. Atropin, for example, paralyzes the vagus, thereby causing a cessation of gastric secretions; pylocarpin, on the other hand, stimulates the vagus, thereby causing an increase in gastric secretions. Adrenalin stimulates the sympaticus and so inhibits gastric secretions. Eppinger and Hess succeeded in demonstrating in the human being characteristic manifestations indicating functional disturbance in either the vagus or sympaticus, or both. Individuals with an increased tone in the vagus system they termed vagotoniacs, while those with increased tone in the sympaticus are named sympaticotoniacs. They also showed that there exist clinical evidences of an increased vagus action in vagotoniacs (contracted pupils, increased salivation, slow heart, increased gastro-intestinal secretions), and an increased sympathetic stimulation in sympaticotoniacs (dilated pupils, dry mouth, flushed face, and diminished gastric secretions).

Not all symptoms have to be present in order to stamp one as a vagotoniac or sympaticotoniac. There are numerous cases in which certain organs show signs of vagotonia and other organs again signs of sympaticotonia. For example, the heart's action may give the signs of a vagotoniac's slowness, respiratory arrhythmia, while the stomach shows signs of sympaticotonia (diminished or absent secretions).

It was Eppinger and Hess again who showed that individuals with a disturbance in either of the above-named systems only demonstrate the condition after the administration of drugs influencing either system. Pilocarpin even in smallest doses provokes vagus symptoms, while adrenalin in equally small doses provokes sympaticus symptoms.

In achylia gastrica it is plausible to assume that there is an inborn or an acquired sympaticotonia. It is very probable that the same patients who have during middle life achylia gastrica on the basis of sympaticotonia may have had in their earlier years hypersecretions on a vagotonia basis. Einhorn rightfully expressed the view that the finding of atrophy of the gastric glands in a prolonged case of functional achylia gastrica is due to inactivity of the glands (disuse atrophy). Knowing through the proved studies of von Bergman[21] and his pupils, J. Kauffman,[22] and our own observations[23] that the hypersecretion accompanying vagotonia may eventually lead to pathological changes in the gastric mucosa (ulcus ventriculi) it is reasonable to assume that a prolonged sympaticotonia inhibiting gastric secretions would eventually lead to atrophy of the gastric glands.

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[21] München. med. Wchnschr., 1913, No. 4, p. 169.

[22] Ztschr. f. klin. Med., 1914.

[23] Arch. Int. Med., March, 1914.

ETIOLOGY. The above discussion would lead us to divide achylia gastrica from the etiological stand-point into three groups:

1. Achylia gastrica with destruction of gastric glands either on the basis of chronic, progressive gastritis (Kuttner), or carcinoma, linitis plastica, alcoholic gastritis with cirrhosis of the liver (Lockwood).

2. Achylia gastrica accompanying marked secondary and primary anemias. To this group belongs the achylia of primary pernicious anemia; the marked anemias accompanying tape-worm; the lowered acidity and even achylia in syphilis as well as the achylia described in chronic rheumatism, gout, hyperthyroidism, etc.

Gravitz was of the opinion that pernicious anemia is secondary to toxins developing as the result of the gastro-intestinal disturbance, especially when accompanied by achylia gastrica. Sahli is likewise of the opinion that pernicious anemia is secondary to achylia gastrica because in the absence of HCl the iron is not assimilated.

From the clinical observations, we agree with the authors who make the anemia responsible for the achylia and not the achylia responsible for the anemia.

3. Achylia gastrica of a functional nature. To this group belong the great majority of cases in whom there is a demonstrable disturbance of the vagosympaticus system with a predominating sympaticotonia of the gastric secretion.

Disqué[24] pointed out that these patients either present the type of status asthenicus (Stiller) or that of the status apoplecticus. In the status asthenicus one usually meets with the mixed type (vagosympathicotoniac), while in the apoplectic type the sympaticotonia may predominate throughout the entire system. The not infrequent occurrence of achylia during the menopause as well as the achylia in Addison's disease show the relation of the sympathetic disturbance to the absence of gastric secretion.

The achylia gastrica secondary to gall-stones and appendicitis or other intra-abdominal diseases as pointed out by Lockwood[25] are also in most cases based on a sympaticotonia. The disease in one of the intra-abdominal organs only serves as an exciting factor in bringing about the manifestations of sympaticus disturbance. This is also the reason why the removal of the cause improves even the gastric secretions.

The interesting experimental work of Carlson and Keenton[26] showed that the removal of the parathyroids produce achylia which is remedied by the administration of calcium.

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[24] Arch. f. Verd., 1914, xx, 366.

[25] Diseases of the Stomach, 1913.

[26] Am. Jour. Phys., 1914, xxxiii, 25.

MORBID ANATOMY. In the functional type of achylia gastrica the gastric mucosa will in the majority of cases not show any macroscopic or microscopic changes in the gastric mucosa.

Only rarely will moderate atrophic changes of the gastric mucosa and secretory glands be met with secondary to inactivity of the glands (disuse atrophy). In the organic type of achylia gastrica partial or complete disappearance of the gastric mucosa is seen with the naked eye. Microscopically various stages of destruction of mucous membrane and glands are seen, such as fatty and cystic degeneration of the glands and atrophy of the mucosa. Cylindrical epithelia frequently assume the shape of goblet cells; rarely the pathological changes are seen to have penetrated the submucosa, muscularis, and serosa.

Age. The affection is most common after the age of forty. Individual cases in earlier life are reported. This affection is much more frequent in men than in women. It is sometimes met with in diabetes, gout, etc., bad teeth are a predisposing factor.

SYMPTOMS. The symptoms of achylia gastrica either on an organic basis or secondary to marked anemia are treated when discussing differential diagnosis between the functional achylia gastrica and the above-named affections. Here only the symptoms pertaining to functional achylia gastrica are being considered.

In a fair number of cases the disease gives rise to no symptoms whatsoever.

There is another class of cases in which diarrhea is the only symptom. Here the stools contain even macroscopically muscle fibers and connective tissue, and are erroneously treated for intestinal disease when in reality the examination of the stomach contents discloses the achylia to be the causative factor for diarrhea, one form of gastrogenic diarrhea.

Another group of cases of achylia have vague gastric disturbances, fulness after meals, nausea, belching, bad taste, and marked dryness in the mouth, etc.

In a small number of cases the symptoms occur periodically with severe epigastric pains, nausea, sometimes even vomiting. The pains are independent of meals, spreading over the entire upper quadrant of the abdomen and radiating to the back. Adolph Schmidt has termed such cases achylia dolorosa. There may be considerable burning in the stomach not relieved by food or bicarbonate of soda. The tongue is coated and appetite is lost. It has even been found that erosions with fatal parenchymatous bleeding resulted in late stages of achylia gastrica. Such bleeding was explained as being due to erosions caused by regurgitated trypsin into the stomach.

O. Gross[27] describes cases of achylia gastrica associated with symptoms pointing toward pancreatic disturbance (bulky, fatty stools, containing an increase in fat, muscle fibers, and starch, and a diminution of the pancreatic ferments in the duodenal contents and stools). He has termed such cases achylia pancreatica. This form of achylia is rare. Whether achylia pancreatica is an independent affection, as O. Gross assumes, or is secondary to a long-standing achylia gastrica, is not definitely settled. Be the symptoms what they may it is characteristic of the functional type of achylia gastrica, that there are very marked intermissions of well-being and that the long duration of the disease does not interfere with the general appearance of the patient. A great majority of these cases even increase in weight notwithstanding their complaints.

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[27] München. med. Wchnschr., 1912.

Diagnosis. This is chiefly based *on the examination of the stomach contents and the stools. From the fasting stomach* we can neither by expression nor by aspiration obtain any contents. Lavaging such an empty stomach one obtains pure wash-water in the greater number of cases; in a lesser number mucus of normal macroscopic and microscopic appearance is found. In the smallest number of cases evidence of an inflammatory condition of the mucous membrane and destruction of glands is seen, such as increase in cellular elements and atrophic appearance of the glands.

To draw diagnostic conclusions from pieces of mucous membrane obtained by aspiration or lavage of the stomach must be employed with care, because fragments of mucous membrane are present even normally as a result of the trauma caused by the aspiration. In achylia, aspiration more readily causes pieces of mucous membrane to become separated because of the existing vulnerability in the gastric mucosa.

The non-finding of particles of mucous membrane does not exclude a pathological change in the lining of the stomach. Only the constant presence of pieces of mucous membrane in the stomach content, showing microscopically destructive changes indicates a diseased condition of the gastric mucosa. This is, however, the exception in the achylia gastrica described by Einhorn and Martius and is regularly found in that form of achylia which is a progressive stage of gastritis subacida (anadeny gastrica, Ewald) and the achylia resulting from diseases of metabolism and blood.

The stomach contents obtained seven or eight hours after a Bourget-Faber test meal (250 c.c. barley soup, 2 slices of bread, 50 grams chopped meat, and 8 prunes) have, according to Kuttner and Lindeman, shown a residue of prune shells. They conclude from this there is a diminished motility in certain cases. This is, however, a hasty conclusion as to the judgment of motility in achylia because the remnant of pieces of prune shells in achylia are more likely due to the fact that the shells stick to the gastric wall because of the absence of fluid.

The removal of the stomach contents one hour after Ewald's test breakfast shows the food to be unchanged, just as if it had only been chewed and only a very small quantity of light fluid flows on top. The food mass shows partially to be interwoven with some mucus. At times no food is obtained one hour after Ewald's test breakfast because of the open pylorus. In such cases we must remove the contents three-quarters or even half an hour after the test breakfast. Such stomach contents are usually entirely devoid of odor, contain no free acid and no combined acids. The total acidity is below 10. Important is the absence of ferments. We must, however, not be satisfied with the diagnosis until a Leube-Riegel meal (400 c.c. meat soup, 150 to 200 grams beefsteak, 150 grams mashed potatoes) is taken by the patient and the stomach contents removed between two and a half and three and a half hours (at the height of digestion). If then no free and combined acids, a low total acidity, and absence of ferments are found the diagnosis is certain. An additional aid in diagnosis has been furnished by Rehfuss and his coworkers by the fractional method of examining stomach contents as described above.

In achylia gastrica we accordingly employ the Gross duodenal tube, and introducing it 50 cm. leave it there for hours, aspirating from time to time. The gastric juice obtained throughout the entire procedure fails to show the presence of free or combined acids. If by the fractional method acid is obtained in the course of digestion one deals with a subacidity or gastritis anacida but not the functional achylia.

Jaworski determines the presence of achylia in the following manner: He gives his patient 300 to 400 c.c. of dilute HCl half an hour before the test breakfast. The contents removed three-quarters to an hour later must show no free or combined acid if there is a true achylia. The examination of the stools may frequently show muscle fiber and free connective tissue. This is particularly marked when diarrhea is present, but even in constipation while connective tissue is not so frequent, muscle fibers are found.

When the disease progresses so that the external secretion of the pancreas is likewise disturbed, fat and starch as well as the diminution of trypsin, amylopsin, and steapsin are found in the duodenal contents and the stools. A diagnostic aid is furnished by Schmidt's test-meal, consisting chiefly of 100 grams of chopped beef half rare. Normally, none or but very few shreds of connective tissue are found microscopically in the stool, while in achylia connective tissue is found in abundance. It must be emphasized that a perfectly normal stool without any evidences of disturbed digestion does not exclude the existence of achylia.

The mode of filling and emptying of the stomach in achylia gastrica as in all gastric affections can best be studied by means of the roentgen ray. The filling of such a stomach, as first pointed out by Holzknecht, is slow. One sees the contrast food stop for thirty seconds or one minute below the air bag, and the food dribbles down to the lower part of the stomach likewise very slowly. This is attributed to the dryness of the stomach wall.

While this explanation sounds plausible it does not completely satisfy our reasoning that the dryness in the stomach alone should account for the slow filling of the cardiac end of the stomach. It appears to us that the slow filling is rather due to the fact that the air bag (magenblase) is much larger in achylia, thereby interfering with the action of the diaphragm, which, according to Cannon, is so important in filling the cardiac end of the stomach with food and furthering it toward the pyloric end.

Peristalsis of the stomach in achylia differs from the normal in the following manner: normally when the first few morsels of food reach the lower pole of the stomach one sees at once a peristaltic wave in the region of the pylorus, sometimes resulting in antrum formation, although but very little or no food at all passes the pylorus. As the stomach fills up completely with food, peristalsis ceases for four or five minutes, when it is again resumed in its normal manner. It begins at a point just opposite the incisura cardiaca running along the greater curvature forming shallow waves. At a point oppsite the incisura angularis the waves deepen finally, forming an antrum. Very small waves are also seen along the lesser curvature.

To recapitulate, we have a period of peristaltic waves in the region of the pylorus corresponding to the gastric secretion met with by the first morsels of food, brought about reflexly by the act of chewing and deglutition. This peristaltic action may be termed the initial period of peristalsis. Then comes the period of filling and strata formation in the stomach when no peristalsis occurs. This may be termed the period of latency. After four to six minutes, corresponding to the time of the real setting in of secretion, the regular course of contraction waves begins.

In achylia gastrica, on the other hand, because of the absence of secretions, the initial peristaltic wave is absolutely missing. The period of latency is unusually prolonged, and when contraction waves begin they are very superficial. We see, therefore, that the roentgen ray observation in relation to peristalsis of the stomach fully confirms the physiological teaching—that peristalsis of the stomach is primarily dependent to a great extent on the secretions. The superficial peristalsis in achylia gastrica is brought about by the mechanical influence of the food.

The emptying of the stomach is unusually rapid in achylia gastrica; because of the absence of the acid reflex, the pylorus is open. This rapid emptying is also present in the great majority of cases in the small intestine, and in a goodly number of cases there is also hypomotility of the colon (achylic diarrhea).

Differential Diagnosis. The diseases from which achylia gastrica is to be differentiated are: gastritis anacida, syphilis of the stomach, carcinoma ventriculi, and heterochylia (Hemmeter).

From gastritis anacida achylia is differentiated by the absence of mucus, the complete absence of ferments, and the non-return of acids by food stimulating secretions or by the giving of dilute HCl before meals (Jaworski). Furthermore, the gastritis anacida has mostly a higher total acidity, and constipation is by far more common than in achylia.

To differentiate achylia gastrica from carcinoma is especially difficult in cases in which achylia is associated with epigastric pains or with a severe anemia. Here all clinical methods helping to establish a diagnosis must be resorted to. The important points are: the higher total acidity in carcinoma, the presence of considerable mucus, an increase in free leukocytes; if stagnation is present we find lactic acid and Boas-Oppler bacilli. In cases in which the carcinoma ulcerates we may succeed in finding cancer cells in the washed-out stomach contents. P. Cohnheim found characteristic flagelli in carcinoma. The persistent finding of occult blood in the stool speaks for carcinoma.

The careful laboratory tests, such as that of Wolf-Junghans, the improved method of staining, the Boas-Oppler bacilli, the formol index, and the glycyltryptophan test,[24] have yielded in a high percentage of cases such valuable results in differentiating carcinoma of the stomach from achylia that it is well worth our efforts to carry out these tests with as much exactness as employed by Smithies.

In the Wolf-Junghans test the patient gets at 4 P.M. on the day previous to the examination one ounce of castor oil. At 6 P.M. of the same day a mixed meal is taken and at 7 P.M. 20 seedless raisins. The following morning the gastric contents are aspirated and lavaged in order to determine whether the stomach is really empty; 200 c.c. of water and 60 grams of two-day old white bread is taken by the patient and removed between fifty and sixty minutes later. The contents are filtered through double HCl-washed filter paper, and the filtrate is first treated for albumin within one hour after removal and then in the following manner.

Into six test-tubes, each of a capacity of 20 c.c., we put stomach contents of 1, $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{10}$, $\frac{1}{20}$, $\frac{1}{40}$ c.c. respectively. To each tube enough distilled water is added to make a total of 10 c.c. This furnishes us therefore the following dilutions of the stomach contents:

Tube 1 equals $\frac{1}{10}$.
2 " $\frac{1}{20}$.
3 " $\frac{1}{40}$.
4 " $\frac{1}{100}$.
5 " $\frac{1}{200}$.
6 " $\frac{1}{400}$.

To each of the tubes we now add 1 c.c. of the following solution:

Phosphotungstic acid	3 c.c.
HCl (concentrated)	10 c.c.
Alcohol (96 per cent.)	200 c.c.
Aqua dest.	ad 2000

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[24] F. Smithies: Carcinoma of the Stomach, Smithies and Ochsner, Saunders, 1916.

If the pearly white zone appears also in the fourth tube the case arouses suspicions of cancer; if in the fifth and sixth tubes we call the result positive.

For finding the Boas-Oppler bacilli Smithies employs the so-called colored agar stain for the gastric extracts, which is made as follows:

Prepare a 2 per cent. solution of agar in distilled water. While the *solution is still hot filter through double HCl-washed filter paper a* few times. Then fractionally sterilize and filter for three consecutive days. Pour 5 c.c. of this solution into test-tubes and plug with sterile cotton.

The stains comprise the following: Unna's polychrome methylene blue and fresh Lugol mixture.

The test is performed thus: Liquefy the contents of one of the test-tubes and divide this into two. To each add 15 drops of stain—the methylene blue to one and the Lugol solution to the other. Mix the contents well and place the tubes in a beaker of boiling water. Now make thin smears of the gastric extracts on two separate slides. Fix these. To each of these add one drop of the staining mixture (the Lugol stain to one and the methylene blue to the other) and drop a cover-slip on each of the preparations. Wait one minute (while the preparations are fixing) and examine microscopically. By this method the Boas-Oppler bacilli stain blue and the starch, etc., is stained brown by the Lugol solution.

Glycyl tryptophan test: Prepare 10 test-tubes, each containing 0.5 c.c. glycyl tryptophan. Add to each 5 c.c. of filtered gastric juice. Then make two additional control tubes, one containing 0.5 c.c. glycyl tryptophan and 5 c.c. of normal saline, the other containing only 5 c.c. of normal saline. To each of the twelve tubes add 0.5 c.c. of toluene, invert the tubes several times and incubate for twenty-four hours at 37° C.

Now have ten clean test-tubes ready. Into each tube introduce 2 c.c. of the mixture below the toluene. To each of these add 3 drops of glacial acetic acid (3 per cent.). Shake tubes well. Then allow bromine vapors to flow into each tube until an amber-yellow color *appears. Shake the tubes again. Examine by daylight. A rose-pink color indicates a positive reaction.*

Formol Index. This test depends on the property of gastric juice from stomach cancers to split peptone into the amino-acids. Hence there is an ereptic enzyme in the stomach contents in this disease. We determine the presence of this enzyme by the amount of amino-acids found (by titration with decinormal sodium hydroxide to phenolphthalein) after treating peptone solution with the suspected gastric contents. The test is performed as follows:

Into a test-tube 20 c.c. of filtered Witte's peptone solution (5 per cent.) and 1 c.c. of filtered gastric juice are introduced. Now three control tubes are prepared, one containing the above plus 10 c.c. of decinormal sodium hydroxide, another containing 20 c.c. of the peptone plus 10 c.c. of the decinormal sodium hydroxide, and the third containing the 20 c.c. peptone alone. To each of the four test-tubes 1 to 2 c.c. of toluene is added (to prevent putrefaction) and are incubated for twenty-four hours at 37° C. Then 10 c.c. of 40 per cent. formaldehyde which has been treated in the following way is added to each. The formaldehyde is neutralized with sodium hydroxide to 0.5 c.c. of phenolphthalein (0.5 per cent. in a 50 per cent. alcohol solution).

Now titrate each tube immediately and in gastric cancer one finds in the first tube an acidity equivalent to 20 c.c. and above of the alkali, in ulcus carcinomatosus 19.8 c.c., in cancer of the liver 4 c.c., in gastric ulcer 12, and in achylia 14.

The different biological tests to facilitate the diagnosis of carcinoma as well as the increase of pepsin in the urine, while scientifically interesting, have not aided in the diagnosis of carcinoma. A great aid in the differential diagnosis is furnished by the roentgen ray, and in a very great majority of cases of carcinoma of the stomach it will supply a clue.

Advanced stages of carcinoma of the stomach show such outspoken changes that a description is not here deemed essential. Only such cases of carcinoma of the stomach will be discussed the structural changes of which are not so marked, and where, unless a very careful roentgenological study is exercised, diagnosis would be impossible. In studying such cases, as in achylia gastrica the mode of filling, peristaltic action, appearance of stomach, and mode of emptying are to be considered. The roentgen ray characteristics of achylia gastrica have been mentioned above.

In carcinoma even in early stages there is a tendency to atony of the stomach so that the food drops down, distending the stomach like a bag. If there is even moderate involvement of the pylorus one sees it fill very slowly, being passively distended, as it were, by the food, unlike the normal pylorus which fills in a ball-like manner, showing visible peristalsis. Peristalsis is persistently absent in that part of the stomach infiltrated by carcinoma, so that the straight, rigid, and transversely stretched-out lesser curvature with absent peristalsis speaks, as well pointed out by Levy-Dorn and Ziegler, for early carcinoma of the lesser curvature. The rigid, elongated, tube-like pylorus indicates early cancer of the pylorus.

The appearance of the stomach is practically as described above—bag-shaped with absence of peristalsis in the affected areas, and usually a dextra-position with a tendency to the *bull-horn shape* of the stomach, the pylorus forming *persistantly the most depending* portion. The emptying of the stomach due to the open pylorus is hastened, and at no time does one see the contractile action of the pylorus. Should the carcinoma of the pylorus have reached a size to offer a partial obstruction to the passage of food we find no change in the mode of emptying in the first part of digestion, but a residue is present six hours after the meal, although the rest of the contrast substance already fills the entire colon down to the rectum.

A form of carcinoma of the stomach that gives the same clinical symptoms as achylia in the absence of palpatory finding occurs in complete scirrhous involvement of the stomach. In such cases the roentgen ray is of inestimable value. It represents an elongated transversely situated tube-like organ lying high in the abdominal cavity, which is seen to serve only as a passage-way for the food. A similar picture is also presented by linitis plastica.

It must be stated, with emphasis, that there are cases in which a differential diagnosis between achylia gastrica and carcinoma is impossible by means of the roentgen ray. These are the cases in which the posterior wall of the stomach alone is involved.

In a certain number of cases, as pointed out by Th. Hausman,[29] achylia gastrica with all the clinical symptoms results on the basis of syphilis. Here the Wassermann reaction and the Noguchi-Luebin reaction will aid a great deal. The importance of the Noguchi-Luebin reaction in syphilitic affections of the stomach is confirmed by F. Smithies[30] in a large number of cases.

It still remains for us to differentiate achylia gastrica resulting on the basis of secondary or primary anemias. The achylias resulting from secondary anemia are determined by establishing the etiological factor (intestinal parasites, metallic poisoning, gout, diabetes, etc.). More important to differentiate is that form of achylia associated with primary pernicious anemia. In these cases a real anadeny exists. The blood picture is the most important diagnostic aid, inasmuch as it shows that we are dealing in the anemia with a hemolytic disease and not with one of digestive disorder. The leading points are: high color index; poly- and hyperchromatic condition of the red blood cells; leukopenia; diminution or absence of blood platelets; diminution of resistance of red blood cells. The work of Eppinger as well as that of J. P. Schneider[31] demonstrating urobilinogen and urobilin. In the chocolate-colored duodenal contents will also serve to demonstrate that the achylia gastrica is secondary to the anemia.

In the diagnosis of achylia we must not overlook the differential diagnosis between it and heterochylia (Hemmeter[32]). By heterochylia we understand a condition in which the gastric secretions show a great tendency to changes in value of acidity. One examination may show a complete achylia and another examination, *after a shorter or longer interval, may show even a hyperacidity.*

If we meet with a heterochylia during the state of achylia and examine the stomach contents of the same patient a few weeks later and find a normal or even a higher acidity we may be misled to attribute the change to the therapeutic effect. The mode of clearing up the differential diagnosis is subject to time. Heterochylia, as pointed out by Hemmeter, shows changes in the acidity values, and the patient has corresponding complains.

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[29] Ergebn. f. inner. Med. im. Kinderheilkund., 1911, vi, 279. Th. Brougsch and Schneider, Berl. klin. Wchnschr., 1915, p. 601.

[30] Arch. Int. Med., January, 1910.

[31] Jour. Am. Med. Assn., August 14, 1915.

[32] Diseases of the Stomach, 1902.

Complications. The most important complication is a resulting organic disturbance of the intestines. The primary diarrhea because of the existing hypermotility in the small and large intestine may eventually lead to fermentative diarrhea and later to catarrh of the small and large intestine.

A rare complication is brought about by the absorption in the blood of toxic proteins, the result of the loss of vicarious digestion on the part of the small intestines. Anaphylactic phenomena and gastro-intestinal disturbances grouped by Vaughn as *protiosis* occur.

Some authors claim that carcinoma may arise on the basis of an achylia. Pernicious anemia, claimed by Grawitz and others to be the result of achylia, does not seem plausible. As already stated above it is rather to be assumed that the achylia is the result of pernicious anemia.

PROGNOSIS. In the functional achylia gastrica prognosis as to life is favorable; the majority of patients even enjoy fairly good health throughout the greater part of their lives. Prognosis as to recovery to normal is unfavorable. Very few cases are reported in which gastric secretions have returned. Achylia gastrica on the basis of lues has a more favorable prognosis as to the return of secretions according to Brugsch and Schneider. According to Lockwood, cases of achylia associated with gall-stones and appendicitis are improved on the removal of the cause.

TREATMENT. Treatment must be strictly individualized, and for the sake of clearness, cases should be separated from the therapeutic stand-point into the following groups:

1. When the symptoms point to a general neurosis with corresponding gastric symptoms. The discovery of achylia in such patients must not lead us to believe that the cause of nervousness has been discovered and that the proper therapeutic measures against achylia will have a favorable influence on the nervous system. In the great majority of cases the reverse holds true. The achylia is the expression of a general neurosis and the treatment must therefore be directed against the nervous system with moderate and appropriate attention to the stomach. Such patients should lead a most regular life, both physically and mentally; they should avoid toxic agents like tobacco and excessive alcohol. Therapeutic measures should be employed, depending upon the general condition of the patient. Robust people should be advised to take once or twice a week some form of sweat bath (box bath or Turkish or electric bath), also a

morning shower. Weak people should take half-baths of 98° to 100° F. temperature with friction of the chest while in the bath and a cold towel on the head, the procedure to last from ten to fifteen minutes, after which water of lower temperature, 90°, is to be poured over the spine. With some patients the cool pack for from a half to an hour is more effective. When the patient can afford frequent and short vacations, either seashore or mountains are very beneficial. For the gastric symptoms a spa containing the sodium chloride waters (Saratoga, Hot Springs, Kissingen, Homburg, Dresden, Tarasp) for one month is very beneficial. In choosing such a spa it is essential to call the attention of the local medical adviser to the existing neurosis so that not the drinking of the waters shall play the main role, nor even the diet, but the general measures to tone up the nervous system shall be of prime importance.

The dietetic régime should not be so strict as to make the patient everlastingly dependent. In a general way we direct him to reduce the daily quantity of meat. He must be told to chew his food well. In this affection thorough chewing almost to the extent of Fletcherizing is of the utmost importance, for as the pylorus is open and as the food passes through the stomach quickly, poorly chewed food serves as an irritant to the small intestine. It is evident that proper attention should be paid to the teeth. Spices in moderation are beneficial (pepper, also cinnamon, salt, caviar, vanilla, orange peel, etc.). Of the liquors a light sour wine with the meals is useful. Lemonade, Billiner waters, Saratoga sparkling water, and sour drinks are preferable to plain water.

To the second group belong cases in which the gastric symptoms predominate (continuous burning right after meals, pressure, and even pain). The symptoms may be so distressing and persistent, and, due to the fear of eating, even cause some loss of weight, that an understanding of the exact nature of the disease is most trying. Lockwood even goes so far as to state that these pains are of extragastric origin (cholelithiasis, appendicitis) and that the removal of the cause would cure the achylia. This does not correspond to our experience. We are rather inclined to think that the persistent and severe symptoms are likewise exaggerated because of the underlying neurosis. That removal of the extragastric disease improves the symptoms of achylia does not prove that this was the cause of the disease, because we know that neuropathic individuals often get well after an exploratory laparotomy, although nothing was found at the operation. All this is stated with the object of showing that while in this group of cases our dietitic and medicinal régime must be more carefully outlined, we must not lose sight of the psychical part of the treatment.

The diet must be guided according to the following principles: The food is prepared sufficiently so as not to be a burden to the intestines mechanically, and must also be of a nature to depend least on stomach digestion and at the same time not to irritate the small intestine. It is best to divide the dietetic treatment into two parts—that of sparing the digestive organs and of exercising those organs. The sparing diet must be individualized as to the kind of food and the length of time such is to be carried out, depending on the severity of the symptoms. When these are very distressing it is necessary to keep the patient on warm milk, cream, and yolks of eggs for the first four or five days, then gradually progress to thin cereals prepared in milk, toast, and butter up to the end of the first week, during all of which time the patient should remain in bed. When the symptoms have considerably diminished we can add bouillon with egg, beef soup, and of the vegetables first mashed potatoes with butter, because they are best borne, then spinach, asparagus tops, string beans, etc., all passed through a purée sieve.

During the second week two or three eggs may be given daily, and the cereals in the form of light puddings or custard. If the patient is fairly comfortable in the second week, noodles and macaroni may be added to the diet. With meat we should begin gradually, and then only with finely scraped or chopped meat well done. Spices and alcoholic beverages should not be allowed while the acute symptoms last. When the symptoms are not of such a severe nature we can at once proceed with a diet corresponding to that described for the third week in the severe cases.

The exercise diet should not begin until the acute symptoms disappear, and even then not abruptly, so as to avoid a recurrence of symptoms, thereby undermining the self-dependence of the patient.

The following list is a fair and sufficient example of what an achylic patient should partake of and be fairly free from disturbance, and at the same time allow him enough variety. The dietetic mode of life for a great length of time of an achylic patient who is subject to gastric symptoms should be the following: In the morning, on an empty stomach, about three-quarters of an hour before breakfast 250 c.c. of hot water to which a half teaspoonful of Nachlorat is added. Breakfast: orange juice or grape fruit, then eggs in any form, with the exception of hard-boiled eggs, cocoa or light coffee or tea, Graham bread or rolls with butter. Two or three times a week we replace the eggs by cereals, mashed potatoes, noodles, macaroni, or cream cheese. Dinner: grape fruit or caviar or anchovies, sardines, sardelles as appetizers, then some bouillon or beef soup or well-prepared vegetable soup mildly spiced. Of the meats either fish, chicken, lamb, veal, or cooked ham, calf's brain, fresh sweetbread or even steak can be given, but thorough chewing is essential besides the proper preparation in the kitchen (well done and finely chopped and mildly spiced with onions, salt, and pepper). Of the vegetables, those named above and a cereal or noodle pudding or omelette, or prune soufflé and cooked fruits. At 4 P.M. one cup of buttermilk with zwieback or toast and butter. Supper: like breakfast, with the addition of some cooked fruits, and buttermilk should replace the coffee.

Severe cases should rest in bed the first week and hot poultices should be applied to the abdomen. If these do not relieve the pain small doses of dionin (gr. 0.01) or pantopon (0.1), two or three times daily, may be given, and in order to secure a restful night, veronal (0.5) in suppositories or adalin (0.5) by mouth may have to be resorted to for a few nights. The bowels should be kept open by a daily salt enema or by an occasional dose of calomel (0.2) in one dose. Should marked nervous symptoms exist during that time a cool sponge bath or cool packs or, as a last resort, bromides in the form of atrontium or sodium bromides (0.6) twice a day may be given.

For bad taste in the mouth one should, besides the antiseptic mouth washes, have the patient use some pleasantly flavored chewing-gum or, as Schule advises, have him chew peppermint leaves, orange peel, or rhubarb root.

A bad taste in the mouth and distention are frequently remedied by a teaspoonful of rhubarb and soda, to be taken three times daily. If meteorism is a disturbing symptom an infusion of peppermint tea (1 to 250 c.c.), taken hot on retiring, is beneficial.

As improvement progresses a more liberal diet is partaken of, the amount of rest depending on the physical condition of the patient chiefly and to some extent also on circumstances. When the patient can afford to do so it is best that he return to routine work very gradually; but if he is to follow up his occupation he must be advised to retire at an early hour and rest after his chief meal for at least half an hour. Hydrotherapeutics in the form of mild douches or warm baths, in the summer season sea baths, are very beneficial.

Medicinally the most important part is the HCl and pepsin:

Acid. hydrochlor. dilute.,		
Pepsini puri	āā 5	10
Aquæ	50	100

S.—One teaspoonful in a glass of water, to be taken before and during the meal.

It may also be given in the form of acidol-pepsin tablets (No. 1 or 2, weaker or stronger), one dissolved in a tumbler of water thrice daily with meals. We are fully aware of the fact that HCl and pepsin do not exercise their beneficial effect by replacing the missing secretions, because they cannot be given in quantities large enough to bring about such an action without having a local and generally poisonous influence, and the secretions cannot be made to return in true achylia. The fact, however, that we clinically see improvement by HCl and pepsin must depend on the improved motility brought about by the above-named drugs. Because of the acid introduced into the stomach the pylorus remains closed for a longer time, the closure and opening of the pylorus depending on the Hirsch-Nehring-Pawlow-Cannon reflex occurs more regularly. Acid even in small quantities excites peristaltic action, thereby mechanically influencing digestion.

When patients complain of loss of appetite it is still customary for some empirically to prescribe the so-called stomachics and amara (tct. nucis vom; extr. fluid. condurang.; mixtur. cuichon. comp.). As to the usefulness of these amara extreme views exist. From the stand-point of the physiological experiments of Carlson[33] and others the stomachics are not only beneficial but they are injurious, inasmuch as they diminish secretions. Many clinicians of great experience (Ewald, Boas), however, still claim favorable results. The ideal stand-point in exciting the appetite is taken by Wm. Sternburg, who states that the proper preparation and variety of food are the best means to that end.

In the gastric type of achylia gastrica, unlike the *pure neuropathic* type, saline mineral waters either at the spas or at home should be employed once a year for four weeks in the quantity of 250 c.c. taken hot in the mornings one hour before breakfast and one or two hours before supper. These waters do not exercise any curative influence on the achylia gastrica, but they bring about considerable improvement. That the waters taken at the spas have a better effect than when taken at home is due to the proper diet, pleasant surroundings, regular mode of life, and well-carried-out physicotherapeutics by trained men. It should be borne in mind that these patients have a tendency to be hypochondriac and proper psychical influence is most important.

When there is a marked tendency to constipation a course of olive-oil enemata lasting from two weeks to a month should be employed, and repeated in the course of intervals as the case may necessitate.

To the third group of cases belong those in which diarrhea is the main symptom. In a number of cases the discovery that the diarrhea is due to achylia gastrica gives us an encouraging hint that the diarrhea will be favorably influenced by the proper treatment. The treatment, however, must be individualized. Patients who have not the symptoms and signs of enteritis are benefited readily by the removal of the milk, by interdicting meat for a few days, and then gradually returning to well-done and finely chopped meat, not exceeding 200 to 250 grams a day. Raw fruits and coarse vegetables (beans, cabbage, lentils, etc.) must be forbidden. The diet consists of *eggs, water cocoa, fine cereals* (rice and barley in particular), *with butter, toasted white bread, macaroni, fish*, and *cream cheese*, and *three-day old kumyss*. Of the drinks red wines are beneficial. Medicinally, HCl and pepsin in the formula given above with and after meals and calcium citrate or calcium phosphate

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[33] Jour. Am. Med. Assn., January 2, 1915; Jour. Phar. and Exp. Therap., November, 1914.

(Boas) in teaspoonful doses in a tumbler of water before meals are beneficial.

In more obstinate cases of diarrhea, and especially when the symptoms point toward enterocolitis, the diet should be restricted to strained barley soups, water cocoa, tea, rice, or sago soups cooked in water to which cinnamon is added for the taste, and almond milk. Almond milk is prepared as follows: Forty sweet almonds and two bitter almonds are placed in boiling water for a few minutes; then the almonds are peeled and ground. Add half a pint warm water, stirring constantly, and pass through a cloth. It should be allowed to stand on ice for two hours before drinking, and should be freshly prepared every day. One hundred grams of red wine are allowed in the course of the day. Such a diet is to be continued for three or four days, during which time the patient should stay in bed with hot poultices or a Prissnitz compress applied to the abdomen. Medicinally we start with 20 grams of castor oil, followed by tannigen 0.2 to 0.3 or tannalbin 0.5 two or three times daily. If there is still intestinal irritation saline enemata (2 teaspoonfuls to a quart of water) or an infusion of chamomile tea (1 to 2 teaspoonfuls to the quart) will prove beneficial. The return to a more substantial diet should be gradual. For at least one month the following diet list will prove efficacious:

Breakfast: One or two soft-boiled eggs, 4 slices toast or zwieback with butter, 250 grams water cocoa to which one or two yolks of eggs are added.

At 10 A.M.: One cup bouillon

At noon: Barley or rice soup; spring chicken or lean fish. Vegetables: 2 tablespoonfuls finely mashed potatoes or spinach or carrots in purée form. Should even these vegetables prove irritating the quantity should be diminished or removed. On the other hand if the patient stands it well we increase the quantity of vegetables. Farina pudding and 60 grams red wine.

At 4 P.M.: 250 grams almond milk or water cocoa with zwieback.

At 7 P.M.: One or two eggs; cereals with butter or barley soup. Oatmeal and barley should be strained. Toast and butter. Water cocoa with yolk of one egg. HCl and pepsin in the formula given above are beneficial, while stringents will probably not be necessary. Should, however, the enteric symptoms persist it is evident that we are confronted with an infectious enterocolitis either brought about, as claimed by Ad. Schmidt, by increase in the existing colon bacilli, or by the colon bacilli changing into virulent organisms, or the existing pathogenic organisms because of the favorable soil and the lowered resistance of the patient gain the upper hand. In this state mild astringents and intestinal antiseptics are necessary. The efficacy of astringents like bismuth subnitrate (0.5 to 1), or dermatol (0.5), tannigen (0.3), tannalbin (0.5), three times daily, is well established. The usefulness of intestinal antiseptics was rightfully disputed by pharmacological experimentation and clinical results. It was shown that small doses have absolutely no effect while doses large enough to be effective are poisonous, and hence the large group like salol, resorcin, ichthyol, menthol, etc., have been discarded. Recent experiences in the present war with the infectious enterocolitis cases have brought forward the mode of administering large doses of intestinal antiseptics, bringing about a curative effect without injurious results. It was found that when drugs like kaolin (bolus alba, or fuller's earth)[34] or animal charcoal are given half an hour before the meal and the intestinal antiseptic half an hour after the meal not only is an absorptive effect on the bacteria and toxins achieved but the slow and minute absorption of the antiseptic into the blood is prevented by the charcoal or kaolin. In other words the antiseptic has its local effect and the rest is eliminated through the bowels with the absorbent substances.

The antiseptic chosen was thymol in doses as large as 0.5 to 1 three times daily half an hour after meals. Of course, other antiseptics, especially β-naphthol or resorcin, may be employed in the same manner. Caution as to the use of large doses of thymol is important. It should be begun with 0.3 to 0.5, and only when such doses are not effective may it be increased. Absolute constipation should be prevented by an occasional dose of castor oil, and the antiseptic should be discontinued as soon as the patient improves, because the prolonged use of thymol has a deleterious effect on the intestinal ferments. For cases in which the symptoms point toward a pancreatic disfunction (achylia pancreatica) we should, with Wahlgemut, restrict carbohydrates for a time; otherwise the diet list is the same as the one outlined above for achylic diarrhea. Medicinally, pancreon 0.5 three times daily after meals should be employed.

Rehfuss[35] has obtained results with parathyroid, one-tenth of a grain t. i. d., given for three-day intervals.

INDICATIONS FOR BLOOD TRANSFUSION.

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To simplify the discussion and condense the indications, I shall divide the conditions in which transfusion is necessary into classes and take up each class separately.

First class: Acute traumatic hemorrhage, both internal and external. This, of course, includes secondary hemorrhage.

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[34] Hess: Jour. Am. Med. Assn., January 8, 1916.

[35] Am. Jour. Med. Sc., July, 1915, p. 72.